Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/368
USSR
February 1964
Original: RUSSIAN

Confidential until official release during Conference

Abstract

EXPERIMENTAL STUDIES ON FAST - NEUTRON REACTOR PHYSICS

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This report deals with the experimental study of some problems of fast-neutron reactor physics. These studies continue a series of experiments on fast reactor physics that has been carried out at the Physical-Energy Institute since 1950. The first results of this experimental series had been reported at the 2-nd International Conference on the Peaceful Uses of Atomic Energy in 1958.

In this report the following problems are considered:

I. Refinement and development of multigroup cross-section sets for nuclear reactors calculation. The importance of different physical effects influencing neutron propagation in media and the possibility of taking them into account in multigroup calculations are discussed (resonance cross-section self-shielding, anisotropy of angular distributions of scattered neutrons, heterogeneous effects, etc.).

2. Studies of neutron propagation in large blocks of material performed on reactor BR-I are described. The results of neutron space-energy distribution measurements in uranium metal, uranium oxide and carbide, thorium, iron, nickel and copper are given. Experimental data of albedo characteristics for different materials (iron, nickel, water, beryllium, etc.) at the boundary with uranium, thorium and uranium carbide are considered.

These investigations are supplemented with spectral measurements of neutron leaving some media (iron, nickel, stainless steel, uranium) that were performed by means of time-of-flight technique on the reactor IBR with 0,04 sec./m reso-

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lution. The results of all the experiments are compared with multigroup calculation data. Cross-section resonance structure effect is revealed as well as the accuracy of taking into account resonance structure values in calculations.

3. The reactor BFS intended for large fast neutron critical assemblies investigation is described. The results of several such assemblies studies with loadings up to some hundreds kilograms of U^{235} are given.

The experiments conducted permitted to define critical masses, conversion ratios, neutron spectral characteristics in different points of the assemblies studied, reactivity perturbations caused by the introduction of some materials in different points of a system, etc.

The problems of the influence of reactor components heterogeneous arrangement (caused by the reactor BFS design features) on physical parameters and neutron space-energy distributions were studied.

The experimental results are compared with the multigroup calculation data.

4. The results of radiative capture cross-section measurements on fissionable isotopes for neutron spectra of the BR-5 core and reflector are given. The measurements were based on detecting of isotope change in materials subjected to long-term irradiation in the reactor.

The results of measurements are compared with miltigroup calculation data. The accuracy of calculations was checked by comparison with experimental distribution of different reactions with the known energy cross-section dependence. The choice of neutron radiative capture group constants for the isotopes studied is discussed.